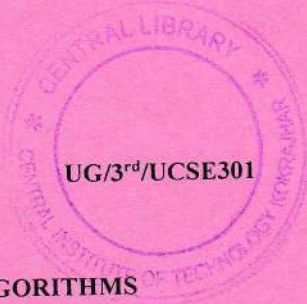Total number of printed pages:3

2021

DATA STARUCTURES AND ALGORITHMS

Full Marks: 100

Time: Three hours

The figures in the margin indicate full marks for the questions.

Answer Question no. 1 and any four questions.

1. Choose the correct alternatives   1×20=20
   (Only write the correct option. For example xxii. (c))

   i. Stack is used in
       a) Recursion   b) Invoking functions   c) All of the above   d) None of the above

   ii. The other name for prefix notation is
       a) Reverse polish   b) Polish   c) Infix   d) None of the above

   iii. Stack can be implemented using
        a) Arrays   b) Linked lists   c) both a & b   d) None of the above

   iv. In Stack data structure, insertions and deletions are made at
       a) both ends   b) one end only   c) middle of the stack   d) None of the these

   v. What is the value of the postfix expression 6 3 2 4 + - * :
       a) Something between -15 and -100   b) Something between -5 and -15

       c) Something between 5 and -5   d) Something between 5 and 15

       e) Something between 15 and 100

   vi. The deque can be used
       a) as a stack   b) as a queue

       c) both as a stack and as a queue   d) None of the above

   vii. A linear list in which elements can be added or removed at either end but not in the middle is known as
        a)Stack   b) Queue

        c) Dequeue   d) Heap

   viii. The initial configuration of queue a, b, c, d('a' is at the front).To get the configuration d, c, b ,a
         One needs a minimum of
         a) 2 deletions and 3 additions

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b) 3 deletions and 2 additions
c) 3 deletions and 3 additions
d) 3 deletions and 4 additions

ix. The rear and front end of a linear queue is used for
    a) deletion, insertion
    b) searching, sorting
    c) insertion deletion
    d) none of these

x. Recursion may be implemented by
    a) linked-list   b) stack   c) queue   d) dequeue

xi. Fibonacci function fib(n)=fib(n-1)+ fib(n-2) is an example of
    a) Linear recursion   b) Binary recursion
    c) Non-linear recursion   d) Mutual recursion

xii. Which of the following traversal techniques lists the elements of a binary search tree in ascending order?
    a) Pre-order   b) Post-order   c) In order   d) None of these

xiii. In a binary search tree, if the number of nodes of a tree is 9, then the minimum height of the tree is
    a) 9   b) 5   c) 4   d) none of these

xiv. Number of possible binary trees with 3 node is
    a) 3   b) 2   c) 4   d) 5

xv. Total nodes in a 2-tree (Strictly binary tree) with thirty leaves are
    a) 60   b) 58   c) 59   d) 57

xvi. In a height balanced tree, heights of two sub –trees of every node differ by more than
    a) 2   b) 0   c) 1   d) -1

xvii. How many BST can be formed with 1,2,3,4?
    a) 1   b) 2   c) 4   d) 6

xviii. A binary search tree is generated by inserting in order the following integers:
50, 15, 62, 5, 20, 58, 91, 3, 8, 37, 60, 24
The number of nodes in the left subtree and right subtree of the root respectively is
    a) (4,7)   b) (7,4)   c) (8,3)   d) (3,8)

xix. Which of the following methods has the best average case complexity for searching?
    b) Hashing   b) Sequential   c) Random   d) Binary

xx. A sort, which iteratively passes through a list to exchange the first element with any element less than it and then repeats with a new first element is called
    a) Bubble sort   b) Quick sort
    c) Heap sort   d) Selection sort

2.

    (a) Write the differences between stack and queue with example.   [4]
    (b) Write an algorithm to convert an infix expression to its postfix form using stack. [8]
    (c) Convert A $ B * C- D +E / F/(G+H) into its **postfix** form using stack. [8]

3.

    (a) Construct the expression tree for the following expression tree: $E = (2a +5b) (x- 7y)^4$ [6]
      (b) Write the recursive function in C for the Towers of Hanoi problem. [6]

      (c) Draw the recursive tree of Tower of Hanoi. [8]

4.

    (a) Write a function to add a node in a single Linked list   [10]
    (c) Complete the following function for reversing the elements of a linked list. [10]

5.

    (a) Construct a binary tree from pre and inorder traversal.   [10]
      ❖ Pre-order- A   B   D   I   E   J   C   F   G   K
      ❖ In-order - D   I   B   E   J   A   F   C   K   G
    (b) Show how the following integers can be inserted in an empty binary search tree in the order they are given: 50,30,   10,   90,   100,   40,   60,   20,   110,   [10]

6.

    (a) Insert the following keys in order given to build them into an AVL tree:
      a z b y c x d w e v   [10]
    (b) Construct a B-tree of **order 3** with the following data
      50, 40,   60,   30,   70,   20,   80,   10,   90,   9,   99 [10]

7.

    (a) Consider an array containing the following 8 integers: **30 10 70 20 50 60 80 40.**
    Suppose we want to sort the array using selection sort. Show the contents of the array after
    every pass.   [10]
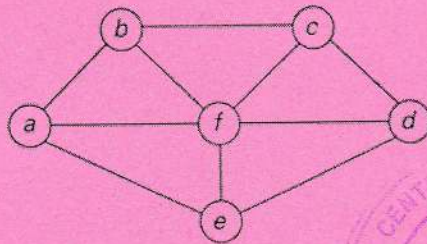   (b) Give the adjacency matrix and adjacency of the graph given in figure 1. [10]

Figure 1

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